

REMARKS

In view of the above amendments and the following remarks, reconsideration of the objections and rejections set forth in the Office Action of July 12, 2005 is respectfully requested.

The Examiner objected to claim 14 because claim 14 as written is a duplicate of claim 12. Due to a typographical error, claim 14 inadvertently depended from claim 1 rather than claim 7, thereby causing claim 14 to be a duplicate of claim 12. However, as indicated above, the dependency of claim 14 has now been corrected so that the claim now depends from claim 7. Consequently, it is respectfully submitted that the Examiner's objection to the claims has been overcome.

In the outstanding Office Action, the Examiner rejected independent claim 1 and several claims that depend therefrom as being unpatentable over the Dubin reference (USP 5,972,192) in view of the Reid reference (USP 6,716,334) and the Landau reference (USP 6,261,433); and rejected independent claim 7 and several claims that depend therefrom as being unpatentable over the Reid reference in view of the Landau reference. Dependent claims 10 and 13 were rejected as being unpatentable over the references applied against their respective base claims, and further in view of the Yamakawa reference (USP 4,906,341). However, the Examiner's prior art rejections are respectfully traversed. For the reasons discussed below, it is respectfully submitted that independent claims 1 and 7 and the claims that depend therefrom are clearly patentable over the prior art of record.

Independent claim 1 is directed to a method for filling metal in fine grooves formed in a surface of a substrate. In particular, independent claim 1 recites that the method comprises plating the substrate, etching the plated metal film, bringing the substrate into contact with a processing liquid *after the etching*, and plating the substrate having the etched metal film to form a remaining film thickness. As explained on page 3, line 25 through page 4, line 3 of the specification, this particular combination of features allows the thickness of the metal to be carefully controlled so as to prevent "humps" from being formed on the substrate. In other words, the step of bringing the substrate into contact with a processing liquid *in combination with and after the step of etching*, significantly improves the results.

In the previous Office Action of December 15, 2005, the Examiner asserted that the Dubin reference disclosed a method of plating a substrate, etching the plated metal film, and then plating the substrate having the etched metal film. In the outstanding Office Action, the Examiner has now asserted that the Reid reference teaches a pretreatment step prior to plating, and that the Landau reference teaches that the pretreatment step can comprise applying a processing liquid that offers surface activity of a surface of the substrate. However, it is submitted that one of ordinary skill in the art would not be motivated to combine the references so as to obtain the present invention.

As the Examiner noted in the Office Action, the Reid reference teaches that it is generally known to perform a pre-treatment process on a wafer, and that the Landau reference teaches that water or several types of solutions can be used to pre-wet a substrate before plating. However, the Examiner does not explain how these references would motivate one of ordinary skill in the art to modify the Dubin reference so as to bring a substrate into contact with a processing liquid *after etching a plated metal film*, in combination with the step of plating a substrate having an etched metal film. In other words, the Examiner has merely established that each of the features recited in independent claim 1 (and particularly, the additional step added in the amendment of April 15, 2005) is known in the prior art. However, the Examiner has not established why the *combination* of features would be obvious to one of ordinary skill in the art, and has not established how the references teach performing the recited steps in the recited order (i.e., bringing the substrate into contact with the processing liquid after etching of the plated metal film). It is submitted that these omissions are particularly relevant in view of the fact that none of the prior art references suggest the benefits achieved by the combination of features recited in independent claim 1 (i.e., to achieve even plating without producing humps).

It is well established that the mere fact that references *can* be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the combination. See *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). In the present case, in view of the unique benefit achieved due to the *combination* of steps (including the recited order in which the steps are to be performed) recited in independent claim 1, and

because the Dubin reference, the Reid reference, the Landau reference, and the Yamakawa references do not suggest this unique combination, it is submitted that one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in independent claim 1. Accordingly, it is respectfully submitted that independent claim 1 and the claims that depend therefrom are clearly patentable over the prior art of record.

Independent claim 7 is directed to a method of plating a substrate with copper, comprising bringing a substrate into contact with a processing liquid, removing the processing liquid and/or drying the substrate, and then bringing the substrate into contact with a plating solution to plate the substrate *after* removing the processing liquid and/or drying the substrate. As explained in the specification, bringing the substrate into contact with the processing liquid will aid in the formation of a plating layer during the subsequent step of plating the substrate. However, if processing liquid remains on the substrate when the substrate is brought into contact with the plating solution, the processing liquid will adversely affect the plating process. Therefore, performing the removal of the processing liquid and/or the drying of the substrate *before* bringing the substrate into contact with the plating solution will improve the plating process.

In the rejection of independent claim 7 in the outstanding Office Action, the Examiner referred to the previous Office Action of December 15, 2004 for detailed comments regarding the rejection. In that previous Office Action, the Examiner asserted that the Reid reference suggests the removal of excess wetting liquid from a substrate surface after pretreatment and “prior to plating.” However, the Examiner’s interpretation of the Reid reference is incorrect. Instead, as explained in column 3, lines 23-60, the Reid reference actually teaches that a wafer is held in a plating solution S, and then lifted out of the plating solution and raised to a position above the plating solution while a rinsing solution is applied to the wafer while the wafer is spun. In other words, the rinsing solution is applied and removed *after* the substrate is brought into contact with a plating solution. The Reid reference does not, however, disclose or suggest bringing a substrate into contact with a processing liquid and then removing the processing liquid and/or drying the substrate *before* the substrate is brought into contact with a plating solution.

The Examiner noted that the Reid reference teaches that pure water entering a solution will dilute the solution, and so the spinning of the wafer above the plating solution prevents the rinsing solution from entering and diluting the plating solution. However, it is to be noted that the Reid reference does not address the issue of residual processing solution remaining on a substrate to be plated, or the affects that the residual processing solution will have on the plating process, because the plating process in the Reid reference is performed *before* the rinsing solution is applied and removed from the substrate.

As explained above, the Reid reference does not disclose or even suggest removing processing liquid from a substrate and/or drying a substrate before bringing the substrate into contact with a plating solution to plate the substrate. In addition, the Landau reference and the Yamakawa reference also do not disclose or suggest removing processing liquid and/or drying a substrate before bringing the substrate into contact with a plating solution, as recited in independent claim 7. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in independent claim 7. Accordingly, it is respectfully submitted that independent claim 7 and the claims that depend therefrom are clearly patentable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. However, if the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact the Applicant's undersigned representative.

Respectfully submitted,

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